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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/010,484	11/20/2001	Fwu-luan Hshieh	GS 150	7850

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EXAMINER

TRAN, TAN N

ART UNIT PAPER NUMBER

2826

DATE MAILED: 07/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/010,484

Applicant(s)

HSHIEH ET AL.

Examiner

TAN N TRAN

Art Unit

2826

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 July 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) 17-21 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____. | 6) <input type="checkbox"/> Other: _____. |

DETAILED ACTION

1. Applicant's communication filed on 07/02/03 has been carefully considered by the examiner. The arguments advanced therein are persuasive with respect to the rejections of record and those rejections are accordingly withdrawn. In view of a further search, however, a new rejection is set forth further below. This action is made final.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's prior Art (APA) in view of Luo (6,251,730).

With regard to claims 1,2,7,14,15, APA discloses a silicon substrate 105 of a first conductivity type (N-type); a silicon epitaxial layer 110 of the first conductivity type (N-type) over the substrate 105, the epitaxial layer 110 having a lower majority carrier concentration than the substrate 105; a trench extending into the epitaxial layer 110 from an upper surface of the epitaxial layer 110; a doped polycrystalline silicon conductive region 125 within the trench adjacent a insulating layer; the insulating layer lining at least a portion of the trench; a body region 130 of a second conductivity type provided within an upper portion of the epitaxial layer 110 and adjacent to the trench; a source region 140 of the first conductivity type provided within an upper portion of the body region 130 and adjacent the trench; an upper region 139 of second conductivity type within an upper portion of the body region 130 wherein the upper region does

not extend to the trench and adjacent the source region 140, the upper region having a higher majority carrier concentration than the body region 130; a borophosilicate glass insulating region 145 disposed over the conductive region, the insulating region 145 extending above the epitaxial layer upper surface. (Note fig. 2 of APA).

APA does not disclose the source contact region comprising: a doped polycrystalline silicon contact region in electrical contact with the source region.

However, Luo discloses the source contact region 13b comprising: a doped polycrystalline silicon contact region in electrical contact with the source region 13b and a metal contact region 33 adjacent the doped polycrystalline silicon contact region 13a and in electrical contact with the source region 13b and with the upper region. (Note lines 56-67, column 4 and lines 44-46, column 7, figs. 4,7,8 of Luo).

Therefore, it would have been obvious to one of ordinary skill in the art to form the APA's device having the source contact region comprising: a doped polycrystalline silicon contact region in electrical contact with the source region and with the upper region such as taught by Luo in order to avoid a high resistance in the shallow source region.

With regard to claim 3, Luo discloses the doped polycrystalline silicon contact region 13a is an N-type polycrystalline silicon region. (Note lines 44-46, column 7, figs. 7,8 of Luo).

With regard to claim 4, APA, and Luo disclose all claimed invention as in claim 3, except doped polycrystalline silicon contact region has a doping concentration ranging from 5×10^{19} to $1 \times 10^{20} \text{ cm}^{-3}$. However, although APA, and Luo do not teach exact doping concentration of doped polycrystalline silicon contact region as that claimed by Applicant, the doping concentration of differences are considered obvious design choices and are not patentable

unless unobvious or expected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note in re Leshin, 125 USPQ 416.

With regard to claim 5, Luo discloses the doped polycrystalline silicon contact region 13a is substantially triangular in cross-section. (Note figs. 7,8 of Luo).

With regard to claim 6, APA fig. 2 discloses an insulating region 145 disposed over the conductive region 125, the insulating region 145 extending above the epitaxial layer 110 upper surface. (Note fig. 2 of APA).

With regard to claim 8, Luo discloses the doped polycrystalline silicon contact region 13a is positioned laterally adjacent to the insulating region 22. (Note figs. 7,8,9 of Luo).

With regard to claim 9, Luo discloses a thickness of the doped polycrystalline silicon contact region 13a is greatest adjacent the insulating region 22, and wherein an upper surface of the doped polycrystalline silicon contact region 13a slopes away from the insulating region 22. (Note figs. 7,8,9 of Luo).

With regard to claim 10, APA discloses an additional region 138 of second conductivity type immediately below the upper region 139, the additional region 138 having a higher majority carrier concentration than the body region 130. (Note figs. 1,2 of APA).

With regard to claim 11, Luo discloses the device comprises a plurality of transistor cells of square geometry or hexagonal geometry. (Note lines 21-27, column 5 of Luo).

With regard to claim 13, Luo discloses the conductive region 11 comprises doped polycrystalline silicon. (Note lines 46-48, column 8, fig. 5 of Luo).

With regard to claims 12,16, APA does not disclose the insulating layer is a silicon oxide layer.

However, Luo discloses the insulating layer 21 is a silicon oxide layer. (Note lines 57-58, column 5, fig. 4 of Luo).

Therefore, it would have been obvious to one of ordinary skill in the art to form the APA's device having the insulating layer is a silicon oxide layer such as taught by Lou because such material is conventional in the art for forming gate insulator.

Response to Amendment

3. Applicant's arguments with respect to claims 1-16 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

4. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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5. Any inquiry concerning this communication or earlier communication from the examiner should be directed to Tan Tran whose telephone number is (703) 305-3362. The examiner can normally be reached on M-F 8:30AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (703) 308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for after final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

TT

July 2003


Minh Lean Tran
Primary Examiner